

CARB-COMPLIANT



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BATTERY-POWERED AUXILIARY AIR CONDITIONING SOLUTIONS

How to Select, Specify, Install, Operate and Maintain
Dometic Battery-Based HVAC System.



DOMETIC BATTERY-POWERED AUXILIARY AIR SOLUTIONS

- ◆ **CARB approved**
- ◆ **Runs on 12V power from bank of Group 31 AGM batteries**
- ◆ **Complies with all anti-idle laws**
- ◆ **Suitable for day cabs or sleepers**
- ◆ **7,000 and 10,000 BTU capacities**
 - **Self-contained package units**
 - **Patented split systems with reusable precharged refrigerant linesets**
- ◆ **Heating options**
 - **1 to 2 KW built-in electric heat**
 - **Interface with installed diesel-fired heaters**
- ◆ **No special tools required to install**
- ◆ **Turnkey package includes all components needed to complete installation**
- ◆ **Backed by extensive application engineering support and nationwide service**
- ◆ **Designed and built for over-the-road conditions and thoroughly field-tested**

In this booklet, we'll explain all aspects of battery-powered auxiliary air conditioning solutions from Dometic Environmental Corporation.

These rugged systems are thoroughly engineered and field tested to provide years of trouble-free performance. They're designed for easy installation without special tools.

The battery-based Dometic aux air systems run on 12 Volt electricity drawn from an on-board bank of batteries through a DC-AC inverter, or from 115 Volt shorepower when an external power source is available. No internal combustion engine is required to produce electricity. They use no fuel, emit no air pollution and are virtually maintenance free. They are 100% CARB compliant, meeting all of the most stringent clean-air laws without any future modifications.

At Dometic, we have a 45+ year heritage of designing and building HVAC systems for the harshest environments. We're especially proud of our reputation for providing the industry's best factory support and after-sale service for our customers. We offer extensive application engineering services to help you select, specify, install and maintain your auxiliary air systems.

We understand you may have a lot of questions about battery-based auxiliary air technology. To get you started, we have written this instructional booklet. We encourage you to read it carefully. If there is anything that is unclear, give us a call, and we'll be delighted to answer any questions you may have.



THE BASICS

The basic principle of an air conditioner is the transfer of heat from one place to another – in this case from the inside of your vehicle to the outside. This is accomplished by absorbing heat from the inside air into a refrigerant gas flowing through an evaporator coil. The refrigerant is then pumped to a condenser, where the heat is released to the outside air. The refrigerant, a chemical with a low evaporation temperature, flows around a closed loop, driven and pressurized by a compressor. As a part of the cooling process, the air conditioner also removes moisture from the inside air, which makes the area feel more comfortable and keeps the compartment dry and mildew-free.

A belt-driven compressor on the truck's engine supplies air conditioning whenever the engine is running. To keep the driver comfortable when the engine is shut down, it is necessary to have a separate auxiliary air conditioning system that uses an alternative source of power.

To that end, Dometic has developed an auxiliary air system that runs on 12 Volt power from an onboard bank of batteries, using a device called an inverter, which converts the 12 Volt DC battery output into 115 Volt AC power. It can also run on 115 Volt electricity from a shorepower hookup. No separate diesel genset or other internal combustion engine is involved. The batteries are automatically recharged by the alternator whenever the truck is running or from shorepower when used with Dometic's recommended inverter/charger unit.

In specifying an all-electric battery-powered HVAC system, you should think of it as an integrated solution comprised of a number of different components, including:

- Heavy-duty deep-cycle batteries, designed for numerous discharge and recharge cycles
- A high-performance alternator with external regulator to recharge the batteries quickly and keep them fully charged
- A correctly sized and specified DC-AC inverter
- The air conditioning components, with associated ducts, grills, electrical power supply and controls
- Shorepower connection



BATTERIES.

Traditionally, truck batteries are designed to provide sufficient power to start the truck's engine and to power lights, blower motors, electrical sensing circuits and other "hotel" loads like a refrigerator or a television set. It takes much more sustained power to run an air conditioning unit for ten hours (and conform to HOS regulations) without recharging. This is why Dometic specifies absorbed glass mat (AGM) batteries. These batteries are a proven technology and are readily available across North America. Dometic's choices have up to 500 cycles in them (about 2 1/2 years of use) and were selected for their deep cycle recovery characteristics and ability to be recharged rapidly. The number of batteries depends on the capacity of the air conditioner, size of the sleeper and the use profile of the truck.

ALTERNATOR.

You will replace your existing alternator with a higher-output unit rated at 185 amps minimum. The size of the new alternator will depend on the total number of batteries to be charged, and we will provide some guidelines in Chapter 3. Unlike traditional truck alternators, these units have an external regulator, which acts as a three-stage charger with a boost phase, a charging phase and a float stage. This regulator is programmed to charge to the specific requirements of an AGM battery. It has sensors for temperature at the regulator and batteries, and also for voltage and will use these sensors to protect the alternator from damage. Leece Neville extends a three year warranty for this alternator and external regulator combination.

INVERTER.

Off-the-shelf inverters are generally designed for relatively light loads, for instance, TVs, microwave ovens, coffee makers and computers. Dometic's air conditioning systems will draw 70 to 100 DC amps for up to ten hours, and, there are momentary spikes when the compressor cuts on. We have developed a specific inverter with an experienced inverter firm that can handle the requirements of an air conditioning system while also being able to handle the normal house loads. It is available as an inverter/charger and as an inverter only. Both have a low-voltage cutout to protect the truck's battery system and ensure re-starting. Dometic's specified systems have never failed to start a truck engine.

SHOREPOWER.

Although there are relatively few shorepower hookups available at truck stops, rest stops and terminals, these will become more readily available in the future. The Dometic all-electric system is designed so that the auxiliary air conditioning system can run on an external 115 Volt power source, which can also simultaneously recharge the truck's batteries when the inverter-charger unit is installed.

AIR CONDITIONING SYSTEM.

Dometic offers a range of models and capacities designed to meet each truck's specific profile – its load requirements and space constraints -- and we will look at these choices on the next page.



AIR CONDITIONING CHOICES



There are two basic types of auxiliary air systems:

- Self-contained “package” units
- Split systems

The self-contained unit is designed to be wholly mounted inside the truck, usually under a berth or seat or inside a side storage locker. All of the air conditioning components, including the compressor, condenser, evaporator, blower and power supply, are mounted on a single low-profile chassis with an aluminum cover. The system’s closed refrigerant loop is precharged and sealed at the factory. Inside air is pulled across the evaporator coil, and cooled air is blown through a flexible duct to a discharge grill for discharge into the living area. Hot air is discharged from the condenser through cutouts in the floorboard.



Dometic’s patented split systems consist of two separate modules. The outside unit contains the condenser and cooling fan. It is bolted horizontally to the underside or vertically to the back of the sleeper. The inside unit contains the compressor, evaporator, blower, power-logic box and other associated components. The inside unit is mounted under a berth or seat or in a side storage locker. The two units are connected by reusable precharged quick-connect refrigerant

Self-contained unit beneath bunk.

linesets. The system is designed so that both units automatically charge to the correct refrigerant pressure as soon as the linesets are connected. No special tools are required.

Each approach offers advantages and disadvantages. A self-contained unit is simpler to install and maintain, since it does not have any external refrigerant lines. It is also less expensive than a split system of the same BTU capacity. On the other hand, it takes more interior space, and it requires cutting holes in the floorboard for air to flow to and from the condenser. A split system, on the other hand, has more installation flexibility and uses less interior space. It also is quieter, since the condenser fan is located outside the truck.

Both types of air conditioning systems can include built-in electrical heat modules. The heat is blown through the same ducts and grills and controlled by the same thermostat. They can also be used in conjunction with a diesel-fired heater if desired, under control of the same thermostat.

Whichever type of system you select, it will come with ducts, grills, condensate drains, thermostat controls and electrical wiring.



Split system inside unit beneath bunk.



Split system outside condensing unit.

Heating Capacity	Application
1.0 KW	48 in. sleeper
1.5 KW	60 in. sleeper
2.0 KW	72 in. sleeper

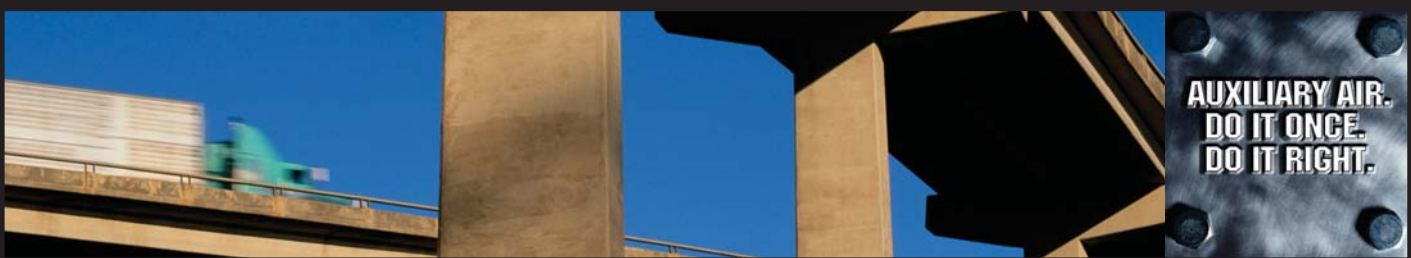


Split Systems

Model	Cool Capacity (BTU)	Heat Capacity	Control	Height (in.)	Width (in.)	Length (in.)	Weight (lb.)	Cool Amps	Heat Amps	Refrigerant
Internal Unit - Evaporator/Heater/Compressor										
ECEQ7	7,000	Cooling only	Smart digital	11.75	10.25	19.25	53	7.3	n/a	R417a
EHCEQ7	7,000	1 KW	Smart digital	11.75	10.25	19.25	53	7.3	8.2	R417a
ECEQ10	10,000	Cooling only	Smart digital	11.63	11.12	20.19	60	11.8	n/a	R417a
EHCEQ10	10,000	7500 BTU Espar Ready	Smart digital	11.63	11.12	20.19	60	11.8	1.0	R417a
EHCEQ10	10,000	1.5 KW	Smart digital	11.63	11.12	20.19	62	11.8	13	R417a
EHCEQ10	10,000	2 KW	Smart digital	11.63	11.12	20.19	62	11.8	17	R417a
External Unit - Condenser										
ACCD7	7,000	n/a	n/a	6.125	11.3125	21.875	10	n/a	n/a	R417a
ACCE10	10,000	n/a	n/a	6.125	12.5	24.5	12	n/a	n/a	R417a

Self-Contained Units

ASCF7	7,000	Cooling only	Mechanical	12.5	15.25	21.5	62	8.5	n/a	R22
ASCEQ7	7,000	Cooling only	Smart digital	11.94	17.75	24	70	8.9	n/a	R417a
ASCEQ7	7,000	7500 BTU Espar ready	Smart digital	11.94	17.75	24	70	8.9	1.8	R417a
ASCEQ7	7,000	1 KW	Smart digital	11.94	17.75	24	71	8.9	9.5	R417a
ASCEQ7	7,000	1.5 KW	Smart digital	11.94	17.75	24	71	8.9	13.4	R417a
ASCDQ10	10,000	Cooling only	Smart digital	12.5	20.87	28.25	91	12.9	n/a	R22
ASCDQ10	10,000	1.5 KW	Smart digital	12.5	20.87	28.25	92	12.9	13.9	R22
ASCDQ10	10,000	2 KW	Smart digital	12.5	20.87	28.25	92	12.9	18.2	R22



SPECIFYING THE SYSTEM

ABOUT INSULATION.

Before we go any further, let's talk briefly about insulation. Most truck sleepers today are insulated with a value of approximately R 1 to R 1.25. Compare this to the insulation of R 30 that is required in most new housing construction. Even the "cold-weather packages" offered with some new trucks only have insulation values of R 2. TMC recommended practices call for R 4.2 as a standard insulation package and greater than R 4.6 in a premium package. This standard, once adopted by the industry, will go a long way toward improving the performance of auxiliary air conditioning and heating systems.

If you are buying a new truck, you should order it with additional insulation. There are also a number of measures you can take to reduce the heat load in your truck. If you have skylights, cover them. Insulate the floors with foam under the carpet. Add insulation to the doors. Get heavy-duty curtains to separate the sleeper from the cab. Cover the windshield and windows with reflective shades when parked. Park in the shade whenever possible. Switch off heat-producing appliances in the sleeper.

AIR CONDITIONING UNITS

Your first step will be determining the type of air conditioning units (split or self-contained) to meet your requirements and space constraints, then sizing the units to meet the expected heat load.

Sizing the system can be a complicated affair, since it depends on a number of factors, such as the size and shape of the sleeper, the amount of insulation (see above), the size and location of windows, the color of the truck (darker colors absorb more heat) and the ambient temperature outside. It also depends on how long you will need to run the system without starting your truck's engine. The following guidelines are based on TMC recommendations for "average" conditions. If you are operating in very hot regions, you may need to consider extra capacity.

Given current insulation conditions, this will usually keep the occupant cool from head to feet when standing, but will not cool a high-rise sleeper all the way to the ceiling.

Remember that in a battery-powered system more BTUs means more batteries.

BATTERIES

To power your Dometic auxiliary air conditioner, you will replace your truck's existing batteries with Group 31 AGM batteries, which are designed to support the heavier loads and frequent discharge/charge cycles.

Engine Off			
Day Cab	42-48" low roof	60" flat roof	60-72" high-rise
7,000 BTU	7,000 BTU	7,000 BTU	10,000 BTU
Note: 14,000 BTU may be used in certain situations where engine-off time is minimal.			
Engine Never Off (No Engine-Driven Air Conditioner)			
Day Cab		Vocational	
10,000 BTU		10,000 BTU	

For a day cab with limited engine-off times (less than 2 hours), we recommend replacing the existing bank of batteries with an equal number of AGM 31 batteries.

For a typical sleeper, you will replace the existing bank of four batteries with AGM 31 batteries, and also install additional batteries. See the chart below for guidelines on the number of batteries required.

Hours Running on House Batteries (AGM Group 31 Batteries)				
# Batteries	7,000 BTU		10,000 BTU	
	100% Run	60% Run*	100% Run	60%* Run
2	1.9	3.8	1.2	2.2
3	3.4	6.1	2.3	3.9
4	4.9	8.5	3.1	5.6
5	6.1	10.6	3.9	7.0
6	7.3	12.8	5.0	8.7
7	8.9	14.9	5.8	10.2
8	10.2	17.1	6.7	11.6

*Air conditioner runs 60% of the time, cycling off and on as needed to maintain desired temperature.

We suggest adding the extra batteries and tying them to the existing bank – creating in effect a single bank of 6 to 8 batteries. There are protective low voltage devices on the inverter will shut down electrical loads whenever the batteries reach a pre-set voltage, thereby ensuring that sufficient power is retained for cranking the engine.

In some cases, it may be desirable to install a separator to isolate two of the batteries from the others. This creates two separate banks – one for "house loads" and the other exclusively for cranking the engine.

One must understand that the effect of adding more batteries on the system. The relationship is not linear. For instance, if two batteries give you 1.5 hours, it does not follow that three batteries would give you an additional .75 hour. This is why – given battery voltage safeguards – we recommend a single bank of batteries without separators.



INSTALLING, OPERATING AND MAINTAINING THE SYSTEM

ALTERNATOR / REGULATOR

Most trucks have a standard 135-amp alternator with internal regulator, which is adequate for keeping the batteries charged under normal conditions. This is not sufficient, however, for the heavier charging requirements for a battery-powered air conditioning system. Dometic specifies a high-output alternator with an external regulator. The regulator acts as a three-stage battery charger that charges and protects the batteries through numerous discharge cycles. These guidelines apply when sizing the alternator:

Number of batteries	Alternator size
6 or less	185 amps
7 to 9	270 amps
10 or more	320 amps

INVERTER

The inverter takes the 12 Volt DC output from the batteries and changes it to 115 Volt AC current, which is fed to the air conditioner and other AC-powered devices. We have tested and evaluated dozens of different inverters, and we have selected a 2,000 Watt unit with a modified sine-wave (MSW) output. This unit includes a 115 Volt pass-through circuit and built-in 50 amp charger to permit you to run the air conditioner and recharge the batteries from shorepower when available. It is also offered as an inverter-only model without the charger. We developed this inverter in conjunction with a company with wide experience in this technology, and we have confidence in its ability to start and run our air conditioning systems. Remember, whenever the air conditioning system cycles on there is a momentary heavy load that the inverter must accept and hold until the compressor gets past its starting requirement. It's only a few milliseconds, but it's very important.

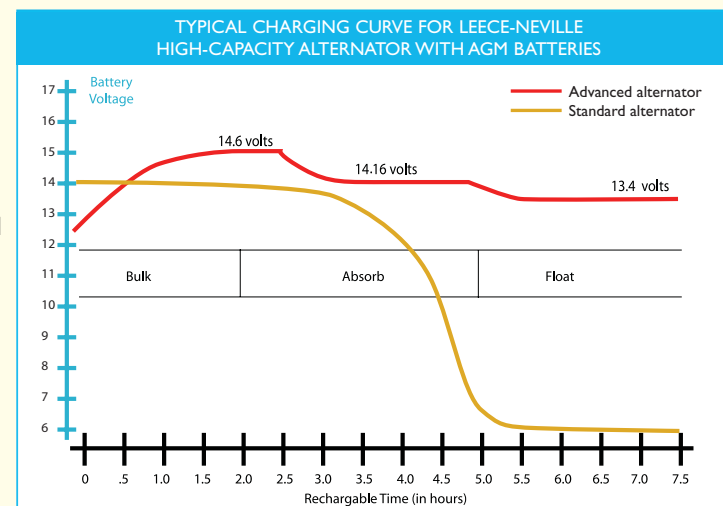
We do not recommend running our air conditioning systems with any inverter not previously tested and approved by Dometic engineering.

SHOREPOWER

Although there are relatively few shorepower hookups available at truck stops, rest stops and terminals, these will become more readily available in the future.

TMC recommends a minimum of one 20-amp circuit for shorepower connections. You should use any heavy-duty power cord with a standard three-prong plug. Remember that there will be a voltage drop across the cord, so you should use the minimum length necessary to reach your outside power source.

12 gauge cord	Up to 25 ft.
10 gauge cord	Up to 50 ft.



INSTALLATION

Dometic will provide detailed installation instructions with your system. You should make sure you understand these instructions and follow them completely.

CONTROLS

The Dometic auxiliary air system comes with a standard digital thermostat/display unit. Operation is intuitive and easy, with up and down arrows to adjust the setpoint and fan speed.

OPTIMIZING PERFORMANCE

To improve the air conditioner's performance on a hot day, you can reduce the heat load by parking in a shaded area, covering the windows with reflective shades to block out direct sunlight and pulling the curtain between the sleeper and cab. Make sure windows and doors are tightly closed, and turn off any other heat-producing appliances.

OPERATION AND MAINTENANCE

Make sure you inspect the batteries frequently. Check for solid electrical connections. Be sure the cable connections are good with no corrosion showing. Check for chafing and moisture.

You should inspect and clean the air filter regularly to ensure good airflow across the evaporator coils. You will find the filter in the return air path, either directly behind the grill or in front of the evaporator coil.

Make sure you do not block the airflow between the return air grill and evaporator coil with pillows, blankets, papers or other objects.

Check the condensate drain often to make sure water is draining properly. Make sure the drain fittings do not get clogged.

If you have a split system with external condensing unit, make sure you inspect and clean any debris from the condenser coil to ensure good air flow.

Dometic's auxiliary air systems, both self-contained and split, are designed so that you should never need recharge the refrigerant loop under normal circumstances. If the refrigerant level ever needs to be adjusted, federal law requires that it must be done by an EPA-licensed HVAC technician with the proper tools to avoid accidental discharge of any refrigerant gas into the air.

Occasionally check for chafe on outside wires and refrigerant lines (split systems).



Dometic Environmental Corporation
www.DometicTruck.com

American Transportation Research Institute
www.atri-online.org

ATA Green Truck Initiative
www.greentruck.com

ATA Technology and Maintenance Council (TMC)
www.truckline.com/issues/governmentpolicy/environment

California Air Resources Board
www.arb.ca.gov

Canadian Office of Energy Efficiency
<http://oee.nrcan.gc.ca/transportation/fleetsmart.cfm>

Cascade Sierra Solutions
www.casadesierrasolutions.org

Environmental Protection Agency SmartWay Program
www.epa.gov/smartway

Pennsylvania Office of Energy and Technology Development
www.dep.state.pa.us

U.S. Department of Energy Clean Cities Program
www.eere.energy.gov/cleancities

West Coast Collaborative
www.westcoastdiesel.org

Dometic is a customer driven, world-leading provider of innovative leisure products for the caravan, motorhome and marine markets. Dometic offers a complete range of air conditioners, refrigerators, awnings, cookers, sanitation systems, lighting, windows, doors and other equipment that makes leisure life more comfortable away from home.

Dometic also provides refrigerators for specific use in hotel rooms, offices, and for storage of medical products and wine along with comfort products designed for the over-the-road truck market. Dometic's products are sold in almost 100 countries and are produced mainly in Dometic's own production facilities around the world. Dometic has more than 4,400 employees.

PATENTS. 7,171,822 • 7,234,315 B2 • 7,140,192 • 7,316,119 • 7,237,397 B2

